

CLAIMS:

What is claimed is:

- 5 1. A process for bleaching a lignin-containing material comprising treating the material with an oxidative enzyme, a mediator that enhances the oxidative activity of said enzyme, and a chain transfer agent.
- 10 2. The process of claim 1 wherein said enzyme has laccase activity.
- 15 3. The process of claim 1 wherein said oxidative enzyme is a laccase, a catechol oxidase, a monophenol monooxygenase, a bilirubin oxidase, or a mixture thereof.
- 20 4. The process of claim 1 that further comprises adding a hydrolase.
- 25 5. The process of claim 3 wherein said hydrolase is xylanase.
6. The process of claim 1 that further comprises adding an oxidizing agent.
7. The process of claim 6 wherein said oxidizing agent comprises at least one of air, oxygen, and hydrogen peroxide.
8. The process of claim 1 wherein said mediator is a hardwood black liquor or a softwood black liquor.
9. The process of claim 1 wherein said chain transfer agent is anthracene, carbon tetrabromide, or a mixture thereof.
10. The process of claim 1 wherein said material is a wood pulp.

11. The process of claim 10 wherein said wood pulp is a raw material used to form a cellulose or a cellulose derivative.

5 12. A process for oxidizing a substrate comprising treating the substrate with an oxidizing enzyme, a mediator that enhances the oxidative activity of said enzyme, and a chain transfer agent.

10 13. The process of claim 12 wherein said oxidizing enzyme is a laccase, a catechol oxidase, a monophenol monooxygenase, a bilirubin oxidase, or a mixture thereof.

14. The process of claim 12 that further comprises adding an oxidizing agent.

15. The process of claim 14 wherein said oxidizing agent comprises at least one of air, oxygen, and hydrogen peroxide.

16. The process of claim 12 wherein said mediator is a hardwood black liquor or a softwood black liquor.

20 17. The process of claim 12 wherein said chain transfer agent is anthracene, carbon tetrabromide, or a mixture thereof.

18. The process of claim 12 that further comprises adding an oxidizing agent.

25 19. The process of claim 18 wherein said oxidizing agent comprises at least one of air, oxygen, and hydrogen peroxide.

20. A composition comprising an oxidative enzyme, a mediator that enhances the oxidative activity of said enzyme, and a chain transfer agent.

21. The composition of claim 20 wherein said enzyme has laccase activity.
 22. The composition of claim 20 wherein said oxidative enzyme is a laccase, a catechol e, a monophenol monooxygenase, a bilirubin oxidase, or a mixture thereof.
 23. The composition of claim 20 that further comprises adding a hydrolase.
 24. The composition of claim 20 wherein said hydrolase is xylanase.

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25. The composition of claim 20 wherein said chain transfer agent is anthracene, carbon tetrabromide, or a mixture thereof.